

Developing pollutant emission models for light and heavy trucks in Tehran

Aidin.Massahi¹, Mansour Hadji Hosseini²

Abstract— This paper presents trucks' pollutant models based on vehicle's speed for main public vehicles' pollutants including CO, NO_x, PM₁₀, VOC, CH₄, HC and SO₂. The traffic emissions are calculated in three route's slope conditions for horizontal, downhill and uphill which are modeled based on an instantaneous emission model integrated with a macroscopic traffic simulation model. Vehicle emission rates depend to its type, the instantaneous speed and vehicle's route slope conditions. Integrated emission models are applied for trucks, which are classified into two categories including light good vehicle and high good vehicle so after presenting emission models, accuracy of them are evaluated by empirical measurements. Some models which are not good compatible with empirical data, have been changed by describing new emission form and new models validity are evaluated by empirical data. Consequently, by considering correlation coefficients can be evaluated new emission models are valid.

Keywords— Instantaneous emission, integrated pollutant emission model, correlation coefficient, trucks, speed.

I. INTRODUCTION

What makes most people worried about improvement of technology is its destroying aspect about our environment, therefore nowadays humankind not only attempts to conduct our life towards more comfortable condition but also he tries to demote environment contamination effects, which are brought about by technology. There is a strong relationship between environment extinction and technology. Had we realized the disadvantageous our environmental destruction, we would have deliberated on it much more meticulously. According to Stephen William Hacking's Theory [13], world are driven into extinction by human activities because he have destroyed his habitat but cannot repair it. Air contamination are taken into account the most important pollution, so it plays a crucial role in destroying our ambience, it is undeniable. Statistics indicate 3 billion people were dead by air pollution effects in 2011[12], therefore, air pollution is one of the most threats against humanity. Nowadays, cars are considered as the most important source of air pollution [8], so this paper presents trucks' air pollution emission models for Tehran, which are classified into two classes. This paper submits air pollution emission models for 7 air pollutants including CO, NO_x, PM₁₀, VOC, CH₄, HC and SO₂ in three different street slope

conditions including uphill, downhill, horizontal for trucks. Moreover, paper calculates correlation coefficients for all of emission models. A new model form are developed for previous emission models that their correlation coefficients do not equal one and correlation coefficients are calculated for these new models. The paper is structured as follows, Section 2 describes requirements and parameters, which are related to emission models. Section 3 presents the method for creating Tehran's pollutant emission models, Section 4, presents correlation coefficients for accuracy of this model, so driven data of this emission models are compared with achieving data which are measured by Tehran Air Quality Control company[10], ultimately new form emission models are presented for models are not good compatible with actual data. Finally, Section 5 presents the conclusions.

II. REQUIREMENTS AND PARAMETERS FOR MODEL

Traffic generated air pollution is a great concern to the general public [3]. Motor vehicles emit nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), particulate matter (PM₁₀), Methane (CH₄), sulfur dioxide (SO₂) and hydrocarbon (HC) which have constituted major sources of air pollution in large cities such as Tehran [14]. Traffic generates greenhouse gases, which consist of reaction hydrocarbons with nitrogen oxides, may contribute to global warming [8].

In this research, heavy trucks and light trucks emission rates are achieved for seven pollutants in three-slope conditions: horizontal, uphill, downhill also these data are measured for 20 (Km/h), 40 (km/h), 60(km/h) and 80 (Km/h). Table 1 depicts heavy trucks emission rates in different speeds and slopes [10].

According to Table 1 data, pollutant emission models should be related to average speed of trucks and slopes. Speed is in road types, volume of cars in their routes, also emission rates have a proportional relation with slope so emission rates in uphill condition is more than downhill condition and horizontal condition. In addition, emission rates have a none linear relation with vehicle speed because emission rates increase at low speeds and high speeds, therefore emission rate are minimum between these speeds. It should be noted that emission rates in table 1 are obtained in standard temperature and pressure.

¹Post Graduate Student, Civil Department, K.N.Tossi University of Technology, Tehran, Iran (e-mail: A.massahi@sina.kntu.ac.ir).

²Assistant professor, Civil Department, K.N.Tossi University of Technology, Tehran, Iran (e-mail: Mansour@Kntu.ac.ir).